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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/742,932	12/23/2003	Junji Noguchi	501.40678CX1	7382

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EXAMINER	
VINH, LAN	

ART UNIT	PAPER NUMBER
1765	

DATE MAILED: 08/03/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/742,932	NOGUCHI ET AL.	
	Examiner	Art Unit	
	Lan Vinh	1765	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *23 December 2003*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *2-17* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *2-17* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date *122303*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

2 Claims 2-4, 11, 14-17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Mikagi (US 6,274,923) in view of Skee et al (US 5,989,353)

Mikagi discloses a method for forming a semiconductor device, the method comprising the steps of:

forming a first insulation film 104 over a major surface of a wafer (col 6, lines 22-23)

forming an interconnect groove in an upper surface of said first insulation (fig.3A)

depositing a metal layer containing copper as its principal component over the upper surface of said first insulating film and inside said interconnect (col 6, lines 39-43)

removing the metal layer outside the interconnect groove by chemical mechanical polishing (CMP) so as to leave a metal interconnect in the interconnect groove (col 6, lines 44-46; fig. 3B)

carrying out first plasma treatment in a first gas atmosphere including an ammonia gas to the major surface of the wafer (col 7, lines 1-2)

carrying out second plasma treatment in a second gas atmosphere including an ammonia gas to the major surface of the wafer (col 7, lines 55-58)

depositing a SiON layer/ insulation copper diffusion barrier film by plasma chemical vapor deposition on the upper surface of said first insulation film and metal interconnect treated by the first and second plasma treatments (col 6, lines 63-65; col 7, lines 5-8; fig. 3E)

Unlike the instant claimed inventions as per claims 2-4, 11, Mikagi fails to disclose the step of wet cleaning using an alkali solution containing aminoethanol and a cleaning treatment using an acid solution after the CMP step

Skee discloses a method for cleaning wafer comprises the step of using an alkali solution containing aminoethanol and a cleaning treatment using an acid solution after the CMP step (col 5, lines 30-35; col 6, lines 1-10)

Hence, one skilled in the art at the time the invention was made would have found it obvious to modify Mikage method by adding the step of wet cleaning in order to remove metal contamination without increasing surface microroughness as taught by Skee (col 4, lines 9-12)

Regarding claim 14, Mikagi discloses depositing the Cu layer by sputtering or CVD (col 6, lines 39-40), which reads on depositing the metal layer by plating technique

Regarding claims 15-17, Mikagi discloses forming the SiON layer/low k dielectric in the chamber/without releasing to air (col 7, lines 5-8)

3. Claims 5-10, 12-13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Mikagi (US 6,274,923) in view of Skee et al (US 5,989,353) and further in view of Ngo et al (US 6,303,505)

Mikagi as modified by Skee has been described above. Unlike the instant claimed inventions as per claims 5-10, 12-13, Mikagi and Skee fails to disclose the step of carrying out a reducing process by heating in a hydrogen plasma after the CMP step

Ngo discloses a method for manufacturing a semiconductor device comprises the step of performing a reducing process by heating in an hydrogen plasma after the CMP step (col 4, lines 23-30; col 5, lines 60-65)

One skilled in the art at the time the invention was made would have found it obvious to modify Mikagi and Skee by adding a reducing step by heating in an hydrogen plasma after the CMP step as per Ngo because Ngo discloses that treatment with a hydrogen-containing plasma effectively cleans the exposed surface of the copper interconnect to present a clean copper or copper alloy for reaction (col 5, lines 27-30)

Conclusion

4. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Lan Vinh whose telephone number is 571 272 1471. The examiner can normally be reached on M-F 8:30-5:30 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nadine Norton can be reached on 571 272 1465. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

LV
August 1, 2005